METHOD FOR CONDITIONING A COMPRESSOR AIRFLOW AND DEVICE THEREFOR

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of the U.S. National Stage designation of co-pending International Patent Application PCT/IB02/04068 filed October 2, 2002, the entire content of which is expressly incorporated herein by reference thereto.

FIELD OF THE INVENTION

The present invention relates to the area of gas turbine technology. In particular, the present invention concerns a process for conditioning a compressor airflow and a device for carrying out the process.

BACKGROUND OF THE INVENTION

An axial compressor **1**, as shown schematically in **FIG. 1**, comprises a rotor **2** that can rotate around an axis **9**, a stator **3**, and a number of blade rings that consist alternatively of the running blades **4** mounted on the rotor **2** and guiding vanes **5** mounted on the stator **3**. For the sake of simplicity, only one blade of each blade ring is shown in each case.

The axial compressor **1** sucks in air at an entrance, which is compressed in the flow channel formed between the rotor **2** and the inside wall of the stator **3** and exits from the exit **10** under elevated pressure. If the axial compressor is part of a gas turbine system, the compressed air leaving at exit **10** is supplied to a downstream combustion chamber and used there for combustion of a fuel. The pressure of the hot gases that develop is then relieved in a downstream gas turbine with energy output.

The airflow sucked in at entrance **11** can be divided into two flows, namely a main flow **A** that flows in the center of the flow channel and a boundary flow **B** that flows along the inside wall of the stator **3**. If for cooling purposes air is now taken from an outlet **6** located between entrance **11** and exit **10**, this air mainly comes from boundary flow **B** while main flow **A** continues to be compressed behind the outlet **6**.

The polytropic efficiency of the axial compressor **1** is not constant over the radial extension of the running blades **4** and guiding vanes **5**. The central airflow is compressed with a better efficiency than that at the rotor **2** and flow currents lying at the

inner wall of the stator **3**. The (branched) air removed at outlet **6**, therefore, has a significantly higher temperature than the air at location **7** in the central flow.

In a case where the air quantity taken from outlet **6** will be used as cooling air for a gas turbine, this temperature elevation is a disadvantage. Instead of simply carrying out a cooling of this airflow (**B**), which usually involves a loss of efficiency in the gas turbine system since more fuel is required, it would be desirable, not only to prevent the temperature increase during compression, but even to achieve a temperature reduction of the boundary flow **B**.

SUMMARY OF THE INVENTION

Advantageously, the invention provides a process for conditioning a compressor airflow that prevents the disadvantages of known processes, and in a simple and effective manner makes possible a reduction in the temperature of the compressed boundary flow at the outlet, as well as a device for carrying out the process.

Advantageously in the present invention, water is brought into the boundary flow between the entrance and the exit, which evaporates while cooling the boundary flow. Because of this, the boundary flow that is later used as cooling air is cooled without the other functions of the compressor being influenced by this.

Preferably, this is achieved in that the water is brought into the axial compressor in such a way that it forms a thin film of water on the inside of the stator. In particular, the water is sprayed into the boundary flow by several nozzles arranged so that they are distributed around the circumference of the stator.

A preferred design of the device according to the invention is distinguished in that the means for bringing in the water consist of several nozzles that are arranged so that they are distributed on the circumference of the stator.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the invention will be described in more detail using the embodiments in connection with the drawing.

FIG. 1 shows a schematic representation of a preferred embodiment of an axial compressor according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Significant parts and functions of the axial compressor shown in **FIG. 1** have already been described in connection with the explanation of the state of the art. According to a preferred embodiment of the invention, in the axial compressor **1**, water (H_2O) is supplied into the flow channel between rotor **2** and stator **3** by way of several nozzles **8** arranged on the circumference of the stator **3**. The water supplied by way of the nozzles **8** forms a thin film of water on the inside of the stator **3** because of the airflow in the flow channel. This water film is in contact with boundary flow **B** and evaporated while cooling boundary flow **B**. The cooled boundary flow **B** is then available at outlet **6** as cooling air for the downstream gas turbine.

Preferably, the nozzles **8** are arranged between adjacent running blades **4** and guiding vanes **5** so that the water film can be formed well. The cooling effect of the evaporating water film is maximum if the nozzles **8** are additionally arranged in flow direction shortly behind the entrance **11** of the axial compressor **1**.